

## Individual Project 6

### Integration by Parts Using Constants

Due Wednesday, Mar. 30

**\*\*\*Read this first!** – You will need to email your professor (me) to get the specific integrals to use in your report. Be sure to do this early enough to get this data and complete your report. (e.g. if you email me at 11:00 PM, I probably will not get you the data until the following day.)

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**Project Assignment:** When we use integration by parts

$$\int u \, dv = uv - \int v \, du$$

and we need to find  $v$  we generally do not include a constant of integration. For example to integrate  $\int x e^x \, dx$  we may set  $u = x$  and  $dv = e^x \, dx$ , and then use  $v = e^x$  instead of  $v = e^x + c$ . This project explores whether or not it is justified to leave off the constant of integration and also whether it could be a benefit to include a constant in some cases.

1. Consider the first integral assigned to you by your professor. Evaluate this integral three different ways using integration by parts. The first time do it in the usual way. Next evaluate the integral again, but this time include the constant of integration “+1.” The last time, include the constant of integration “+c.” Compare the answers and explain any differences. Which was the easiest technique?
2. Consider the second integral assigned to you by your professor. Evaluate this integral using integration by parts in the usual way. (Hint: consider both possible orderings for integration by parts, one will be easier. If you find a function you are unfamiliar with, look its derivative and integral up in the list at the end of the calculus book.) Then find a constant of integration that makes the last integration trivial. Compare the answers and explain any differences. Which was the easiest technique for this integral?
3. Make a conjecture relating integration by parts with and without using the constant of integration. Your conjecture should have hypotheses and conclusions and involve arbitrary functions  $u$  and  $v$ .

You should print your report and turn it in by the due date.